

(c.) Remarks

New claim 4 is basically the same as original claim 1 with the added language that the shower plate is “interposed between a second end of said film-forming gas introducing pipe and said film-forming chamber”, and further includes the addition of the final phrase of the claim stating “said cleaning-gas introducing means communicating directly with said film-forming chamber without passing through said shower plate.” Claims 5 and 6 are identical to original claims 2 and 3 as amended.

The plasma film-forming apparatus of claim 4 is characterized by the mutual arrangement of the film-forming gas introducing pipe (15), the shower plate (5) and the cleaning-gas introducing means (23).

As shown in FIG. 2, the shower plate (5) is interposed between the film-forming gas introducing pipe (15) and the film-forming chamber (10). In the film-forming operation, the film-forming gas is supplied through the film-forming gas introducing pipe (15) on to the shower plate (5), and is ejected uniformly into the film-forming chamber (10) from the numerous holes of the shower plate (5). Thus, the film is formed on the substrate (9) with uniform thickness distribution.

The cleaning-gas introducing means (23) communicates directly with the film-forming chamber (10) without passing through the shower plate (5). The numerous holes of the shower plate (5) are not deeply positioned in the cleaning-gas of the film-forming chamber (10)

which comes from the cleaning-gas introducing means (23). During the cleaning of the film-forming chamber (10), the cleaning-gas containing free radicals are supplied through the cleaning-gas introducing means (23) into the film-forming chamber (10) without passing through the numerous holes of the sower plate (5). Accordingly, most radicals can be prevented from dissipating before being introduced into the film-forming chamber (10). Accordingly, the film-forming chamber (10) can be effectively cleaned.

With this apparatus, both uniform film thickness distribution on the substrate and effective cleaning of the film-forming chamber are achieved.

The apparatus of Yin et al. (U.S. 6,379,575) has no shower plate for introducing the film-forming gas into the inside of the chamber (30). Accordingly, a film may be formed on the substrate (25) with nonuniform thickness distribution.

The apparatus of Li et al. (U.S. 5,772,771) has no shower plate. The process gas is introduced into the vacuum chamber (18) through the plural pipes (70), (72), (62) shown in FIG. 1 and numerous pipes (34) shown in FIG. 4. On the contrary, the apparatus of this invention requires only one pipe (15) because of the use of the shower plate (5) having numerous holes.

In Yamamoto et al. (U.S. 4,252,595), the activated gas is introduced into the inside of the chamber (109) through the plural nozzle holes 128. Accordingly, the radicals included in the activated gas may be dissipated when the radicals pass through the plural nozzle holes 128.

The claimed apparatus including the film-forming gas introducing pipe, the shower plate and the cleaning-gas introducing means is not disclosed in the above references. Accordingly, the mutual arrangement of the film-forming gas introducing pipe, the shower plate and the cleaning-gas introducing means of this invention, cannot be obtained from or suggested by the above references. Thus, in the above references, the uniform film thickness distribution on the substrate and the effective cleaning of the film-forming chamber are not achieved.

Concerning claims 5 and 6, which depend on claim 4, the same arguments hold true.

In view of the foregoing amendments and remarks, it is believed that this application is now in condition for allowance. Accordingly, reconsideration with Notice of Allowance is requested.

Respectfully submitted,

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